

Joint Products & By Products

Learning Objectives

After studying this chapter, you should be able to

- Understand and differentiate between Joint and By products
- Understand the different methods joint cost apportionment over joint products
- Understand the different methods joint cost apportionment over by-products
- Understand the accounting treatment required for joint products and by products

10.1 Meaning of Joint Products and By-Products

Agricultural product industries, chemical process industries, sugar industries, and extractive industries are some of the industries where two or more products of equal or unequal importance are produced either simultaneously or in the course of processing operation of a main product.

In all such industries, the management is faced with the problems such as, valuation of inventory, pricing of product and income determination, problem of taking decision in matters of further processing of by-products and/or joint products after a certain stage etc. In fact the various problems relate to

- (i) apportionment of common costs incurred for various products and
- (ii) aspects other than mere apportionment of costs incurred upto the point of separation.

Before taking up the above problems, we first define the various necessary concepts.

Joint Products - Joint products represent “two or more products separated in the course of the same processing operation usually requiring further processing, each product being in such proportion that no single product can be designated as a major product”.

In other words, two or more products of equal importance, produced, simultaneously from the same process, with each having a significant relative sale value are known as joint products. For example, in the oil industry, gasoline, fuel oil, lubricants, paraffin, coal tar, asphalt and kerosene are all produced from crude petroleum. These are known as joint products.

Co-Products - Joint products and co-products are used synonymously in common parlance, but strictly speaking a distinction can be made between two. Co-products may be defined as

two or more products which are contemporary but do not emerge necessarily from the same material in the same process. For instance, wheat and gram produced in two separate farms with separate processing of cultivation are the co-products. Similarly timber boards made from different trees are co-products.

By-Products - These are defined as “products recovered from material discarded in a main process, or from the production of some major products, where the material value is to be considered at the time of severance from the main product.” Thus by-products emerge as a result of processing operation of another product or they are produced from the scrap or waste of materials of a process. In short a by-product is a secondary or subsidiary product which emanates as a result of manufacture of the main product.

The point at which they are separated from the main product or products is known as split-off point. The expenses of processing are joint till the split –off point.

Examples of by-products are molasses in the manufacture of sugar, tar, ammonia and benzole obtained on carbonisation of coal and glycerin obtained in the manufacture of soap.

Distinction between Joint-Product and By-Product - The main points of distinction as apparent from the definitions of Joint Products and By-Products are:

- a) Joint products are of equal importance whereas by-products are of small economic value.
- b) Joint products are produced simultaneously but the by-products are produced incidentally in addition to the main products.

10.2 Apportionment of joint costs

Joint product costs occur in many industries such as petroleum, oil refinery, meat-making, textiles, dairy, flour mill, saw mill and many other process industries and top management of business concerns require the accountants to give their opinion for many managerial decisions such as to process further or to sell at split-off stage. To answer this question they require apportionment of joint costs over different products produced.

The main problem faced in the case of joint products/ by-products is the apportionment of the total cost incurred upto the point of separation of joint products/ or by products. For costs incurred after the split off point there is no problem, as these costs can be directly allocated to individual joint products or by-products. Thus the apportionment of joint costs over different products produced involve the following two cases.

1. When two or more products are simultaneously produced and there is by-product.
2. When there are both joint products and by-products.

10.3 Method of apportioning joint cost over joint products

Proper apportionment of joint cost over the joint products is of considerable importance, as this affects (a) Valuation of closing inventory; (b) Pricing of products; and (c) Profit or loss on

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the sale of different products.

The commonly used methods for apportioning total process costs upto the point of separation over the joint products are as follows:

- (i) Physical unit method
- (ii) Average unit cost method
- (iii) Survey method
- (iv) Contribution margin method
- (v) Market value method :
 - (a) At the point of separation
 - (b) After further processing
 - (c) Net realisable value.

(i) **Physical Unit Method:** This method is based on the assumption that the joint products are capable of being measured in the same units. Accordingly joint costs here are apportioned on the basis of some physical base, such as weight or measure expressed in gallons, tonnes etc. In other words, the basis used for apportioning joint cost over the joint products is the physical volume of material present in the joint products at the point of separation. Any loss arising during the stage of processing is also apportioned over the products on the same basis. This method cannot be applied if the physical units of the two joint products are different. The main defect of this method is that it gives equal importance and value to all the joint products.

Illustration 1: (Apportionment of joint costs on the basis of physical unit method)

A coke manufacturing company produces the following products by using 5,000 tonnes of coal @ ₹ 15 per tonne into a common process.

Coke	3,500 tonnes
Tar	1,200 tonnes
Sulphate of ammonia	52 tonnes
Benzol	48 tonnes

Apportion the joint cost amongst the products on the basis of the physical unit method.

Solution

	Products					Total
	Coke	Tar	Sulphate of Ammonia	Benzol	Wastage	
Output (in tonnes)	3,500	1,200	52	48	200	5,000
Wastage (in tonnes)	146	50	2	2		200
(apportioned on the basis of weights)						

Total weight (in tonnes)	3,646	1,250	54	50	5,000
Joint Cost (in ₹) @ ₹ 15 per tonne	54,690	18,750	810	750	75,000

Note : 1. Apportionment of wastage of 200 tonnes over the four products is as follows:

Coke :	$\frac{200}{4,800} \times 3,500$ tonnes	=	146 tonnes
Tar :	$\frac{200}{4,800} \times 1,200$ tonnes	=	50 tonnes
Sulphate of ammonia :	$\frac{52}{4,800} \times 3,500$ tonnes	=	2 tonnes
Benzol :	$\frac{48}{4,800} \times 3,500$ tonnes	=	2 tonnes

(ii) **Average Unit Cost Method:** Under this method, total process cost (upto the point of separation) is divided by total units of joint products produced. On division average cost per unit of production is obtained.

Average unit cost = Total process cost (upto the point of separation) ÷ Total units of joint product produced.

This is a simple method. The effect of application of this method is that all joint products will have uniform cost per unit. If this method is used as the basis for price fixation, then all the products may have more or less the same price. Under this method customers of high quality items are benefitted as they have to pay less price on their purchase.

Illustration 2 (Apportionment of joint costs on the basis of average unit cost method)

Find out the cost of joint products A, B and C using average unit cost method from the following data :

(a) Pre-separation Joint Cost ₹60,000

(b) Production data :

Products	Units produced
A	500
B	200
C	<u>300</u>
	<u>1,000</u>

Solution

$$\text{Average cost per unit} = \frac{\text{Total joint costs}}{\text{Units produced}} = \frac{\text{₹ 60,000}}{1,000 \text{ units}} = \text{₹ 60}$$

The joint costs apportioned @ ₹ 60 are as follows :

Products	Units	Costs per unit (₹)	Value (₹)
A	500	60	30,000
B	200	60	12,000

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C	300	60	<u>18,000</u>
			<u>60,000</u>

(iii) **Survey Method:** This method is also known as point value method. It is based on technical survey of all the factors involved in the production and distribution of products. Under this method joint cost are apportioned over the joint products, on the basis of percentage/point values, assigned to the products according to their relative importance. The percentage or points used for the purpose are usually computed by management with the help of technical advisers. This method is considered to be more equitable than other methods.

(iv) **Contribution Margin Method:** According to this method, joint costs are segregated into two parts - variable and fixed. The variable costs are apportioned over the joint products on the basis of units produced (average method) or physical quantities. In case the products are further processed after the point of separation, then all variable cost incurred be added to the variable costs determined earlier. In this way total variable cost is arrived which is deducted from their respective sales values to ascertain their contribution. The fixed costs are then apportioned over the joint products on the basis of the contribution ratios.

Illustration 3 (Apportionment of joint costs on the basis of contribution margin method)

Find out the cost of joint products A and B using contribution margin method from the following data :

Sales

A : 100 kg @ ₹ 60 per kg.

B : 120 kg @ ₹ 30 per kg.

Joint costs

Marginal cost ₹ 4,400

Fixed cost ₹ 3,900

Solution

The marginal cost (variable cost) of ₹ 4,400 is apportioned over the joint products A and B in the ratio of their physical quantity i.e. 100 : 120

$$\text{Marginal cost for Product A : } ₹ 4,400 \times \frac{100}{220} = ₹ 2,000$$

$$\text{Marginal cost for Product B : } ₹ 4,400 \times \frac{120}{220} = ₹ 2,400$$

The fixed cost of ₹ 3,900 is apportioned over the joint products A and B in the ratio of their contribution margin i.e. 40 : 12

(Refer to working note)

$$\text{Product A : } ₹ 3,900 \times 40/52 = ₹ 3,000$$

$$\text{Product B : } ₹ 3,900 \times 12/52 = ₹ 900$$

Working Note:

Computation of contribution margin ratio

Products	Sales revenue (₹)	Marginal cost (₹)	Contribution (₹)
A	6,000	2,000	4,000
B	3,600	2,400	1,200
(Refer to above)			

Contribution ratio is 40 : 12

(v) Market Value Method: This is the most popular and convenient method because it makes use of a realistic basis for apportioning joint costs. Under this method joint costs are apportioned after ascertaining “what the traffic can bear”. In other words, the products are made to bear a proportion of the joint cost on the basis of their ability to absorb the same. Market value means weighted market value *i.e.* units produced × price of a unit of joint product.

(a) Market value at the point of separation: This method is used for the apportionment of joint costs to joint products upto the split off point. It is difficult to apply this method if the market value of the products at the point of separation is not available. It is a useful method where further processing costs are incurred disproportionately.

To determine the apportionment of joint costs over joint products, a factor known as multiplying factor is determined. This multiplying factor on multiplication with the sales values of each joint product gives rise to the proportion of joint cost.

$$\text{Multiplying factor: } \frac{\text{Joint Cost}}{\text{Total Sales Revenue}} \times 100$$

For example, a concern incurs a joint cost of ₹ 64,500 in producing two products A (200 units), B (200 units) and earns a sales revenue of ₹ 86,000 by selling @ ₹ 170 per unit of product A and product B @ ₹ 260 per unit. The multiplying factor in this case is obtained by dividing the total joint cost by total sales revenue and finally multiplying the figure so obtained by 100. The multiplying factor based on the data can be computed as follows:

$$\text{Multiplying factor: } \frac{₹ 64,500}{₹ 86,000} \times 100 = 75\%$$

$$\begin{aligned} \text{Joint cost apportioned over product A} &= \text{Sales revenue of product A} \times 75\% \\ &= ₹ 34,000 \times 75\% \\ &= ₹ 25,500 \\ \text{Joint cost apportioned over product B} &= \text{Sales revenue of product B} \times 75\% \\ &= ₹ 52,000 \times 75\% \\ &= ₹ 39,000 \end{aligned}$$

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Alternatively - This joint cost may be apportioned in the ratio of sales values of different joint products.

(b) Market value after processing: Here the basis of apportionment of joint cost is the total sales value of finished products and involves the same principle as discussed in (a) above. Suppose that in the example given in Part (a) above, if sales prices of products A and B after further processing are ₹ 200 and ₹ 300 respectively the joint cost apportioned over Products A and B is as follows:

The pre-separation costs of ₹ 64,500 will be apportioned in the ratio of (2 : 3) as follows:

Market sales value after further processing

		(₹)
A : 200 units × ₹ 200	=	40,000
B : 200 units × ₹ 300	=	<u>60,000</u>
		<u>1,00,000</u>

Joint cost apportioned :

$$A = ₹ 64,500 \times \frac{₹ 40,000}{₹ 1,00,000} = ₹ 25,800$$

$$B = ₹ 64,500 \times \frac{₹ 60,000}{₹ 1,00,000} = ₹ 38,700$$

The use of this method is unfair where further processing costs after the point of separation are disproportionate or when all the joint products are not subjected to further processing. The *net realisable value method* which is discussed as below overcomes the shortcoming of this method.

(c) Net realisable value method: From the sales value of the joint products (at finished stage) the followings are deducted:

- (i) estimated profit margins,
- (ii) selling and distribution expenses, if any, and
- (iii) post-split off costs.

The resultant figure so obtained is known as net realisable value of joint products. Joint costs are apportioned in the ratio of net realisable value. Suppose that in the example given in part (a) above if further processing costs for products A and B are ₹ 4,000 and ₹ 32,000 respectively the Joint cost may be apportioned to products A and B as follows:

Products	Sales revenue (₹)	Further processing cost (₹)	Net realisable value (₹)	Joint cost apportionment ratio
	(a)	(b)	(c)=(a)-(b)	
A	34,000	4,000	30,000	3/5
B	52,000	32,000	20,000	2/5

Joint cost apportioned over product A = ₹ 64,500 × $\frac{3}{5}$ = ₹ 38,700

Joint cost apportioned over product B = ₹ 64,500 × $\frac{2}{5}$ = ₹ 25,800

This method is extensively used in many industries.

Illustration 13 (Apportionment of joint cost under different methods)

Inorganic Chemicals purchases salt and processes it into more refined products such as Caustic Soda, Chlorine and PVC. In the month of July, Inorganic Chemicals purchased Salt for ₹40,000. Conversion of ₹ 60,000 were incurred upto the split off point, at which time two sealable products were produced. Chlorine can be further processed into PVC.

The July production and sales information is as follows:

	Production (tonne)	Sales quantity (tonne)	Selling price (per tonne)
Caustic Soda	1,200	1,200	₹ 50
Chlorine	800	—	—
PVC	500	500	₹200

All 800 tonnes of Chlorine were further processed, at an incremental cost of ₹ 20,000 to yield 500 tonnes of PVC. There was no beginning or ending inventories of Caustic Soda, Chlorine or PVC in July.

There is active market for Chlorine. Inorganic Chemicals could have sold all its July production of Chlorine at ₹75 per tonne.

Required :

- (1) *To calculate how joint cost of ₹1,00,000 would be apportioned between Caustic Soda and Chlorine under each of following methods :*
 - (a) *Sales value at split off,*
 - (b) *Physical measure (method), and*
 - (c) *Estimated net realisable value.*
- (2) *Lifetime Swimming Pool Products offers to purchase 800 tonnes of Chlorine in August at ₹75 per tonne. This sale of Chlorine would mean that no PVC would be produced in August. How the acceptance of this offer for the month of August would affect operating income ?*

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Solution:

1. (a) Sales value at split off method

Products	Sales in tonnes (a)	Selling price per tonne (₹) (b)	Sales revenue (₹) (c)=(a) × (b)	Joint cost apportioned* (₹)
Caustic Soda	1,200	50	60,000	50,000
Chlorine	800	75	60,000	50,000
			1,20,000	1,00,000

$$\text{* Apportioned joint cost} = \frac{\text{Total joint cost}}{\text{Total sale value}} \times \text{Sale revenue of each product}$$

$$\text{Joint cost apportioned to Caustic Soda} = \frac{₹1,00,000}{₹1,20,000} \times ₹60,000 = ₹50,000$$

$$\text{Joint cost apportioned to Chlorine} = \frac{₹1,00,000}{₹1,20,000} \times ₹60,000 = ₹50,000$$

- (b) Physical measure method

Products	Sale in (tonnes)	Joint cost (₹) apportioned **
Caustic Soda	1,200	60,000
Chlorine	800	40,000
	2,000	1,00,000

$$\text{**Apportioned joint cost} = \frac{\text{Total joint cost}}{\text{Total physical value}} \times \text{Physical units of each product}$$

$$\text{Joint cost apportioned to Caustic Soda} = \frac{₹1,00,000}{2,000 \text{ tonnes}} \times 1,200 \text{ tonnes} = ₹60,000$$

$$\text{Joint cost apportioned to chlorine} = \frac{₹1,00,000}{2,000 \text{ tonnes}} \times 800 \text{ tonnes} = ₹40,000$$

- (c) Estimated net realisable value method

Products	Sale revenue (₹) (a)	Further processing cost (₹) (b)	Net realisable value (₹) (c) = (a) – (b)	Apportioned*** Joint cost (₹)
Caustic Soda (1,200 tonnes × ₹50)	60,000	–	60,000	42,857
Chlorine	1,00,000	20,000	80,000	57,143

(500 tonnes of PVC × ₹200)	1,40,000	1,00,000
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**Apportioned joint cost = $\frac{\text{Total joint cost}}{\text{Total net realisable value}} \times \text{Net realisable value of each product}$

Apportioned joint cost for Caustic Soda = $\frac{₹ 1,00,000}{₹ 1,40,000} \times ₹60,000 = ₹42,857$

Apportioned joint cost for Chlorine = $\frac{₹ 1,00,000}{₹ 1,40,000} \times ₹80,000 = ₹57,143$

2. Incremental revenue from further processing of Chlorine into PVC	
(500 tonnes × ₹200 – 800 tonnes × ₹75)	₹40,000
Less : Incremental cost of further processing of Chlorine into PVC	<u>₹20,000</u>
Incremental operating income from further processing	<u>₹20,000</u>

The operating income of Inorganic Chemicals will be reduced by ₹20,000 in August if it sells 800 tonnes of Chlorine to Lifetime Swimming Pool Products, instead of further processing of Chlorine into PVC for sale.

Illustration 5 (Preparation of income forecast statement and suggest production plan)

Sun-moon Ltd. produces 2,00,000 : 30,000; 25,000; 20,000 and 75,000 units of its five products A, B, C, D and E respectively in a manufacturing process and sells them at ₹17, ₹13, ₹8, ₹10 and ₹14 per unit. Except product D remaining products can be further processed and then can be sold at ₹25, ₹17, ₹12 and ₹20 per unit in case of A, B, C and E respectively.

Raw material costs ₹35,90,000 and other manufacturing expenses cost ₹5,47,000 in the manufacturing process which are absorbed on the products on the basis of their 'Net realisable value'. The further processing costs of A, B, C and E are ₹12,50,000; ₹1,50,000; ₹50,000 and ₹1,50,000 respectively. Fixed costs are ₹4,73,000.

You are required to prepare the following in respect of the coming year:

- (a) *Statement showing income forecast of the company assuming that none of its products are to be further processed.*
- (b) *Statement showing income forecast of the company assuming that products A, B, C and E are to be processed further.*

Can you suggest any other production plan whereby the company can maximise its profits? If yes, then submit a statement showing income forecast arising out of adoption of that plan.

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Solution

Working Note:

Statement showing apportionment of joint costs on net realisable value basis

Products	Sales value (1) (₹)	Post separation (2) (₹)	Net realisable value (1)-(2)=(3) (₹)	Apportioned joint costs (4) (₹)
A	50,00,000 (2,00,000 units × ₹ 25)	12,50,000	37,50,000	26,25,000
B	5,10,000 (30,000 units × ₹ 17)	1,50,000	3,60,000	2,52,000
C	3,00,000 (25,000 units × ₹ 12)	50,000	2,50,000	1,75,000
D	2,00,000 (20,000 units × ₹ 10)	—	2,00,000	1,40,000
E	15,00,000 (75,000 units × ₹ 20)	1,50,000	13,50,000	9,45,000
			<u>59,10,000</u>	<u>41,37,000</u>

Total joint cost = Raw material costs + Manufacturing expenses
= ₹ 35,90,000 + ₹ 5,47,000 = ₹ 41,37,000

Apportioned joint cost = $\frac{\text{Total joint cost}}{\text{Total net realisable value}} \times \text{Net realisable value of each product}$

Apportioned joint cost for Product A = $\frac{₹ 41,37,000}{₹ 59,10,000} \times ₹ 37,50,000 = ₹ 26,25,000$

Similarly, the apportioned joint cost for products B, C, D and E are ₹ 2,52,000; ₹ 1,75,000; ₹ 1,40,000 and ₹ 9,45,000 respectively.

(a) Statement showing income forecast of the company assuming that none of its products are further processed

	Products					Total (₹)
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)	
Sales revenue	34,00,000 (2,00,000 units × ₹ 17)	3,90,000 (30,000 units × ₹ 13)	2,00,000 (25,000 units × ₹ 8)	2,00,000 (20,000 units × ₹ 10)	10,50,000 (75,000 units × ₹ 14)	52,40,000
Less: Apportioned joint cost	<u>26,25,000</u>	<u>2,52,000</u>	<u>1,75,000</u>	<u>1,40,000</u>	<u>9,45,000</u>	<u>41,37,000</u>
						(Refer to working note)

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Excess of revenue over joint cost of manufacturing	7,75,000	1,38,000	25,000	60,000	1,05,000	11,03,000
Less: Fixed cost						<u>4,73,000</u>
Profit						6,30,000

(b) Statement showing income forecast of the company: assuming that products A, B, C and E are further processed (Refer to working note)

	Products					Total
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)	(₹)
Sales revenue : (X)	50,00,000	5,10,000	3,00,000	2,00,000	15,00,000	75,10,000
Apportioned joint cost : (Y)	26,25,000	2,52,000	1,75,000	1,40,000	9,45,000	41,37,000
Further processing cost : (Z)	12,50,000	1,50,000	50,000	-	1,50,000	16,00,000
Total manufacturing cost : (K)=(Y)+(Z)	38,75,000	4,02,000	2,25,000	1,40,000	10,95,000	57,37,000
Excess of sales revenue over total manufacturing cost : [(X)-(K)]	11,25,000	1,08,000	75,000	60,000	4,05,000	17,73,000
Less: Fixed cost						<u>4,73,000</u>
Profit						<u>13,00,000</u>

Suggested production plan for maximising profits:

On comparing the figures of excess of revenue over cost of manufacturing in the above statements one observes that the concern is earning more after further processing of A, C and E products but is loosing a sum of ₹ 30,000 in the case of product B (if it is processed further). Hence the best production plan will be to sell A, C and E after further processing and B and D at the point of split off. The profit statement based on this suggested production plan is as below :

Profit statement based on suggested production plan

	Products					Total
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)	(₹)
1	2	3	4	5	6	7
Sales revenue : (X)	50,00,000	3,90,000	3,00,000	2,00,000	15,00,000	73,90,000
Appointed joint cost : (Y)	26,25,000	2,52,000	1,75,000	1,40,000	9,45,000	41,37,000
Further processing cost : (Z)	12,50,000	-	50,000	-	1,50,000	14,50,000
Total manufacturing cost : (K)=(Y)+(Z)	38,75,000	2,52,000	2,25,000	1,40,000	10,95,000	55,87,000
Excess of sales revenue over manufacturing cost : [(X)-(K)]	11,25,000	1,38,000	75,000	60,000	4,05,000	18,03,000

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Less: Fixed cost	4,73,000
Profit	13,30,000

Hence the profit of the company has increased by ₹ 30,000.

10.4 Methods of apportioning joint cost over by-products

The following methods may be adopted for the accounting of by-products and arriving at the cost of production of the main product:

(a) Market value or value on realisation: The realisation on the disposal of the by-product may be deducted from the total cost of production so as to arrive at the cost of the main product. For example, the amount realised by the sale of molasses in a sugar factory goes to reduce the cost of sugar produced in the factory.

When the by-product requires some additional processing and expenses are incurred in making it saleable to the best advantage of the concern, the expenses so incurred should be deducted from the total value realised from the sale of the by-product and only the net realisations should be deducted from the total cost of production to arrive at the cost of production of the main product. Separate accounts should be maintained for collecting additional expenses incurred on :

- (i) further processing of the by-product, and
- (ii) selling, distribution and administration expenses attributable to the by-product.

(b) Standard cost in technical estimates: By-products may be valued at standard costs. The standard may be determined by averaging costs recorded in the past and making technical estimates of the number of units of original raw material going into the main product and the number forming the by-product or by adopting some other consistent basis.

This method may be adopted where the by-product is not saleable in the condition in which it emerges or comparative prices of similar products are not available.

(c) Comparative price: Under this method, the value of the by-product is ascertained with reference to the price of a similar or an alternative material.

Suppose in a large automobile plant a blast furnace not only produces the steel required for the car bodies but also produces gas which is utilised in the factory. This gas can be valued at the price which would have been paid to a gas company if the factory were to buy it from outside sources.

(d) Re-use basis: In some cases the by-product may be of such a nature that it can be reprocessed in the same process as part of the input of the process. In that case the value put on the by-product should be same as that of the materials introduced into the process. If, however, the by-product can be put into an earlier process only, the value should be the same as for the materials introduced into the process.

10.5 Treatment of By-Product Cost in Cost-Accounting

By-product cost can be dealt in cost accounting in the following ways:

(a) **When they are of small total value:** When the by-products are of small total value, the amount realised from their sale may be dealt in any one the following two ways :

1. The sales value of the by-products may be credited to the Profit and Loss Account and no credit be given in the Cost Accounts. The credit to the Profit and Loss Account here is treated either as miscellaneous income or as additional sales revenue.
2. The sale proceeds of the by-product may be treated as deductions from the total costs. The sale proceeds in fact should be deducted either from the production cost or from the cost of sales.

(b) **When the by-products are of considerable total value:** Where by-products are of considerable total value, they may be regarded as joint products rather than as by-products. To determine exact cost of by-products the costs incurred upto the point of separation, should be apportioned over by-products and joint products by using a logical basis. In this case, the joint costs may be divided over joint products and by-products by using relative market values; physical output method (at the point of split off) or ultimate selling prices (if sold).

(c) **Where they require further processing:** In this case, the net realisable value of the by-product at the split-off point may be arrived at by subtracting the further processing cost from the realisable value of by-products.

If total sales value of by-products at split-off point is small, it may be treated as per the provisions discussed above under (a).

In the contrary case, the amount realised from the sale of by-products will be considerable and thus it may be treated as discussed under (b).

10.6 Summary

Joint Products - Two or more products of equal importance, produced, simultaneously from the same process, with each having a significant relative sale value are known as joint products.

Co-Products - Two or more products which are contemporary but do not emerge necessarily from the same material in the same process.

By-Products - Products recovered from material discarded in a main process, or from the production of some major products.

Method of apportioning joint cost over joint products:

The commonly used methods for apportioning total process costs upto the point of separation over the joint products are as follows :

- (i) *Physical unit method*
- (ii) *Average unit cost method*
- (iii) *Survey method*
- (iv) *Contribution margin method*
- (v) *Market value method :*
 - (a) *At the point of separation*
 - (b) *After further processing*
 - (c) *Net realisable value.*

Methods of apportioning joint cost over by-products :

(a) *Market value or value on realisation-* The realisation on the disposal of the by-product may be deducted from the total cost of production so as to arrive at the cost of the main product.

(b) *Standard cost in technical estimates-* The standard may be determined by averaging costs recorded in the past and making technical estimates of the number of units of original raw material going into the main product and the number forming the by-product or by adopting some other consistent basis.

This method may be adopted where the by-product is not saleable in the condition in which it emerges or comparative prices of similar products are not available.

(c) *Comparative price-* Value of the by-product is ascertained with reference to the price of a similar or an alternative material.

(d) *Re-use basis-* The value put on the by-product should be same as that of the materials introduced into the process.

Treatment of By-Product Cost in Cost-Accounting

- (i) *When they are of small total value:*
 1. *The sales value of the by-products may be credited to the Profit and Loss Account and no credit be given in the Cost Accounts. The credit to the Profit and Loss Account here is treated either as miscellaneous income or as additional sales revenue.*

2. *The sale proceeds of the by-product may be treated as deductions from the total costs. The sale proceeds in fact should be deducted either from the production cost or from the cost of sales.*
- (ii) *When the by-products are of considerable total value - The joint costs may be divided over joint products and by-products by using relative market values ; physical output method (at the point of split off) or ultimate selling prices (if sold).*
- (iii) *Where they require further processing -The net realisable value of the by-product at the split-off point may be arrived at by subtracting the further processing cost from the realisable value of by-products.*

If total sales value of by-products at split-off point is small, it may be treated as per the provisions discussed above under (i).

In the contrary case, the amount realised from the sale of by-products will be considerable and thus it may be treated as discussed under (ii).